US006659449B2

(12) **United States Patent**
Kim

(10) **Patent No.: US 6,659,449 B2**
(45) **Date of Patent: Dec. 9, 2003**

(54) **PICKUP DEVICE FOR USE IN AN IMAGE FORMING APPARATUS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 132 days.

(21) Appl. No.: **09/962,683**

(22) Filed: **Sep. 26, 2001**

(65) **Prior Publication Data**

US 2002/0084574 A1 Jul. 4, 2002

(30) **Foreign Application Priority Data**

Dec. 29, 2000 (KR) 2000-86388

(51) **Int. Cl.**[7] **B65H 43/00**
(52) **U.S. Cl.** **271/117**; 271/164
(58) **Field of Search** 271/117, 164, 271/176, 199, 215; B65H 43/00, 43/04, 7/18, 1/22, 1/26, 3/06

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(57) **ABSTRACT**

A pickup device for use in an image forming apparatus has a cassette detachably mounted in a body of the image forming apparatus, and a pickup roller for picking up paper piled on the cassette and feeding it to an image forming engine portion by being moved upward and downward in association with loading/unloading of the cassette. Accordingly, overall size of the image forming apparatus is reduced, while improvement in performance and life span is guaranteed due to minimization of mechanical trouble, obtained by preventing possible collision between the pickup roller and the cassette being loaded, or preventing interference between the pickup roller and the paper. Also, information about paper exhaustion and paper remaining in the cassette is provided in real time.

34 Claims, 6 Drawing Sheets

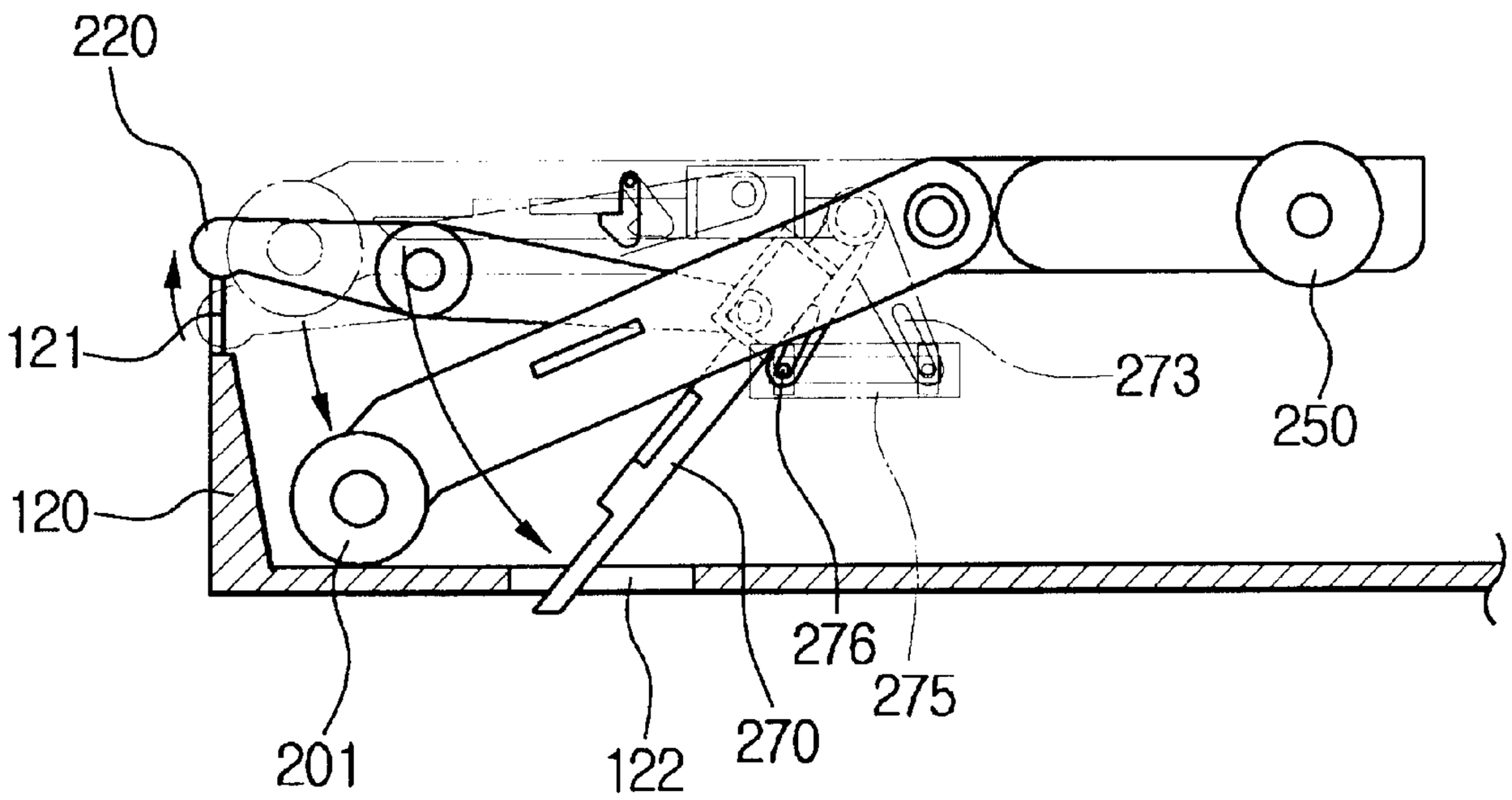


FIG. 1

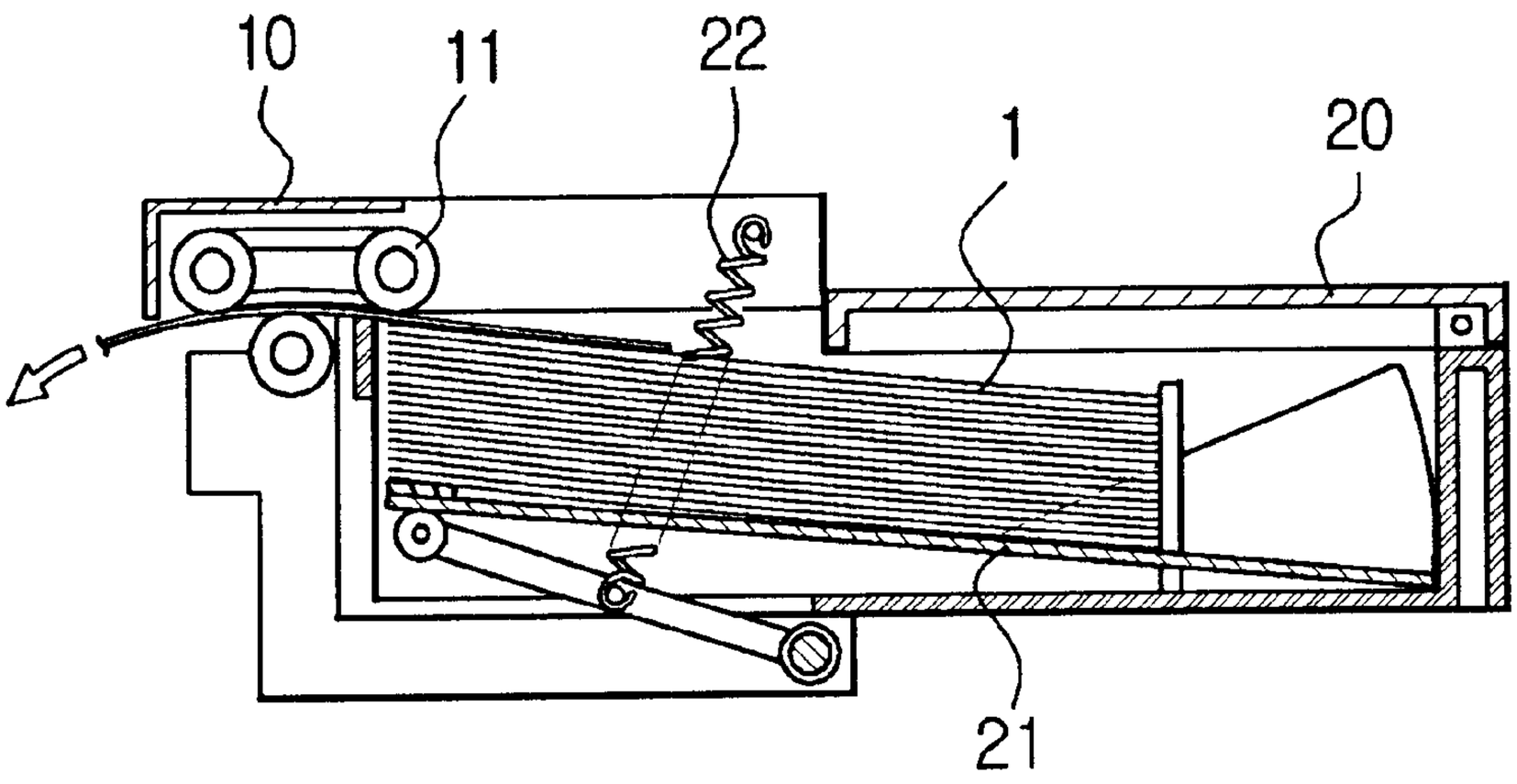


FIG. 2

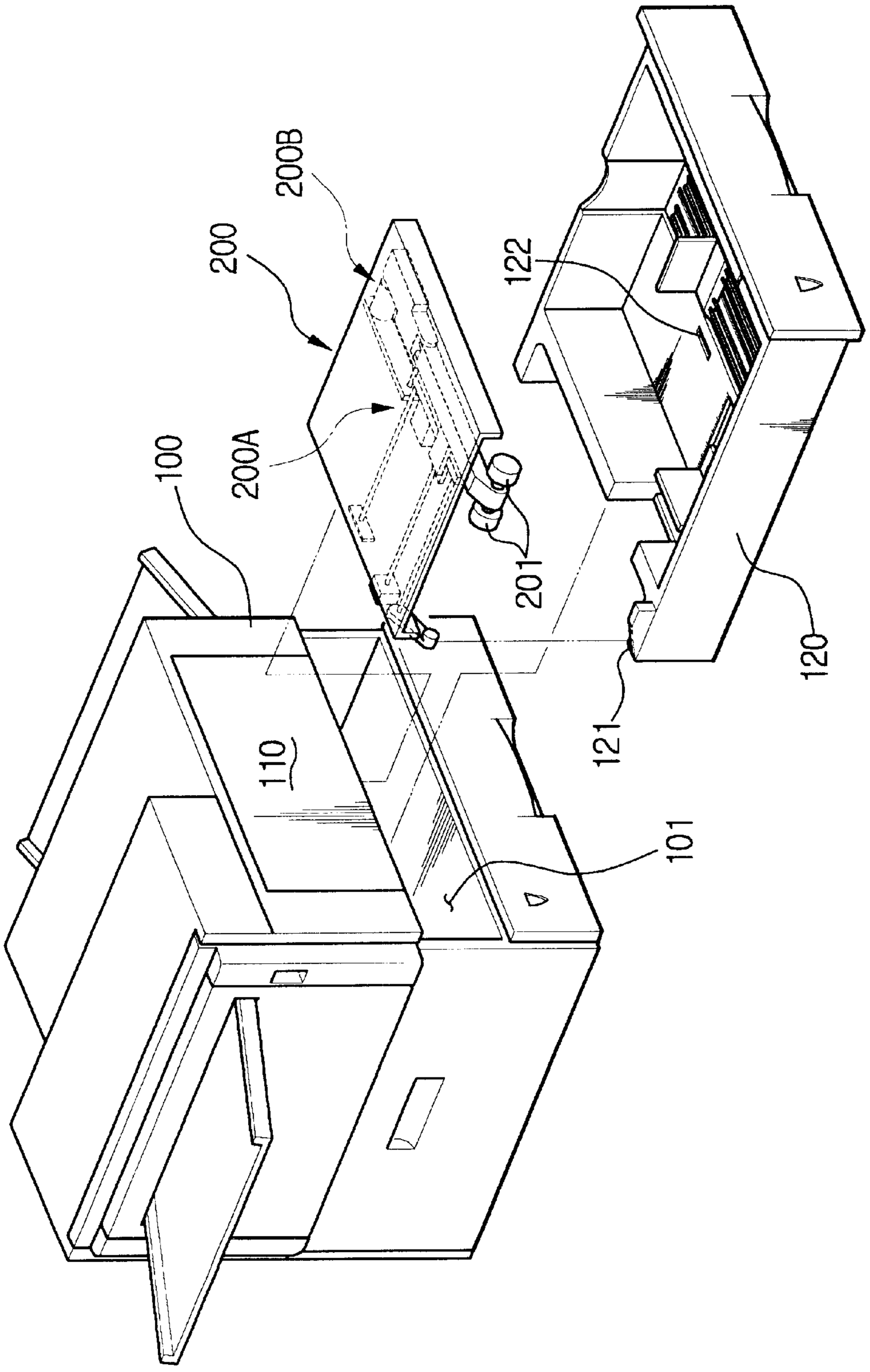


FIG.3

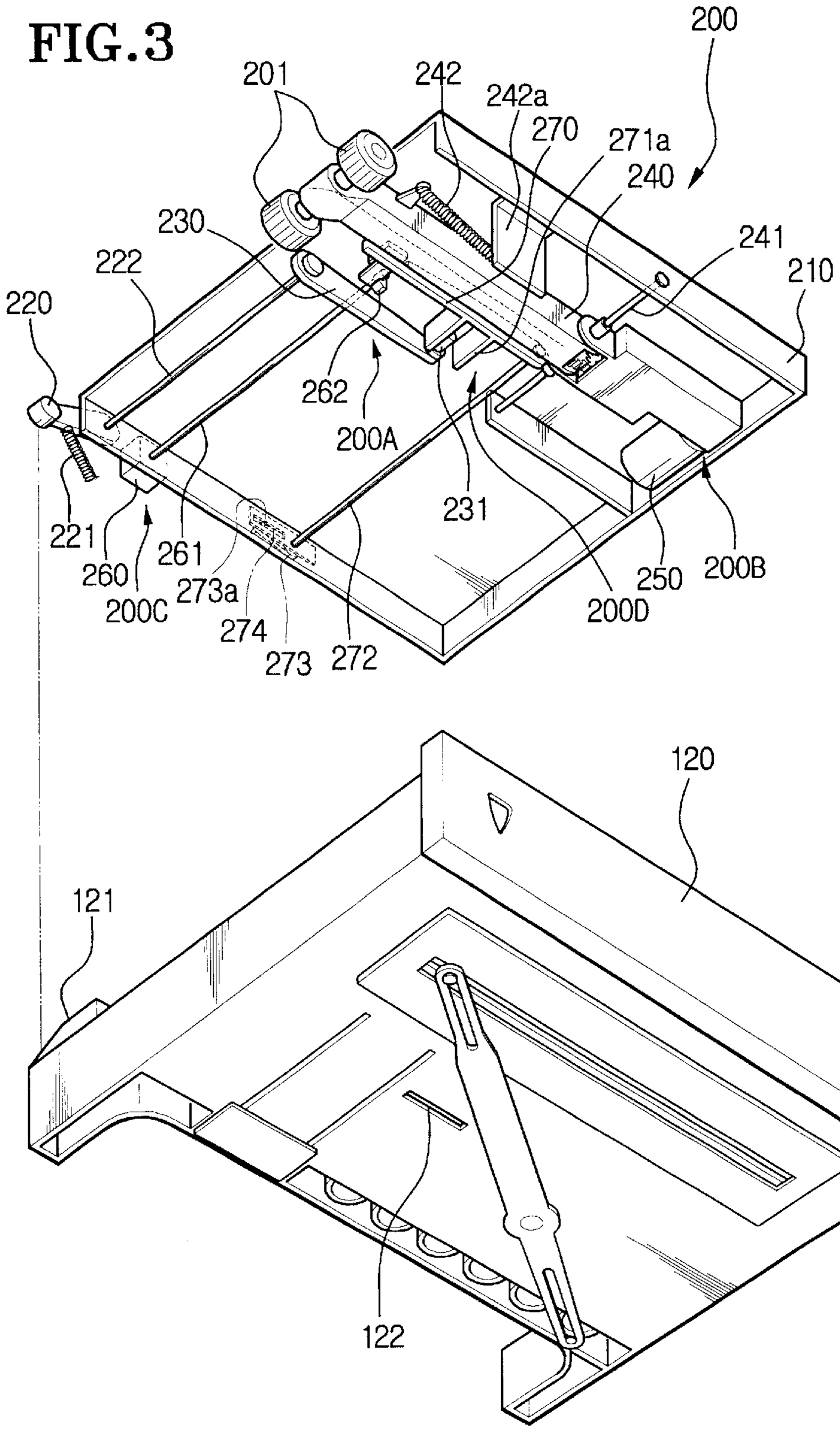

200
201
242
242a
270
271a
240
230
241
210
222
220
262
200A
231
221
260
261
273a
200C
274
273
272
250
200B
200D
120
121
122

FIG.4

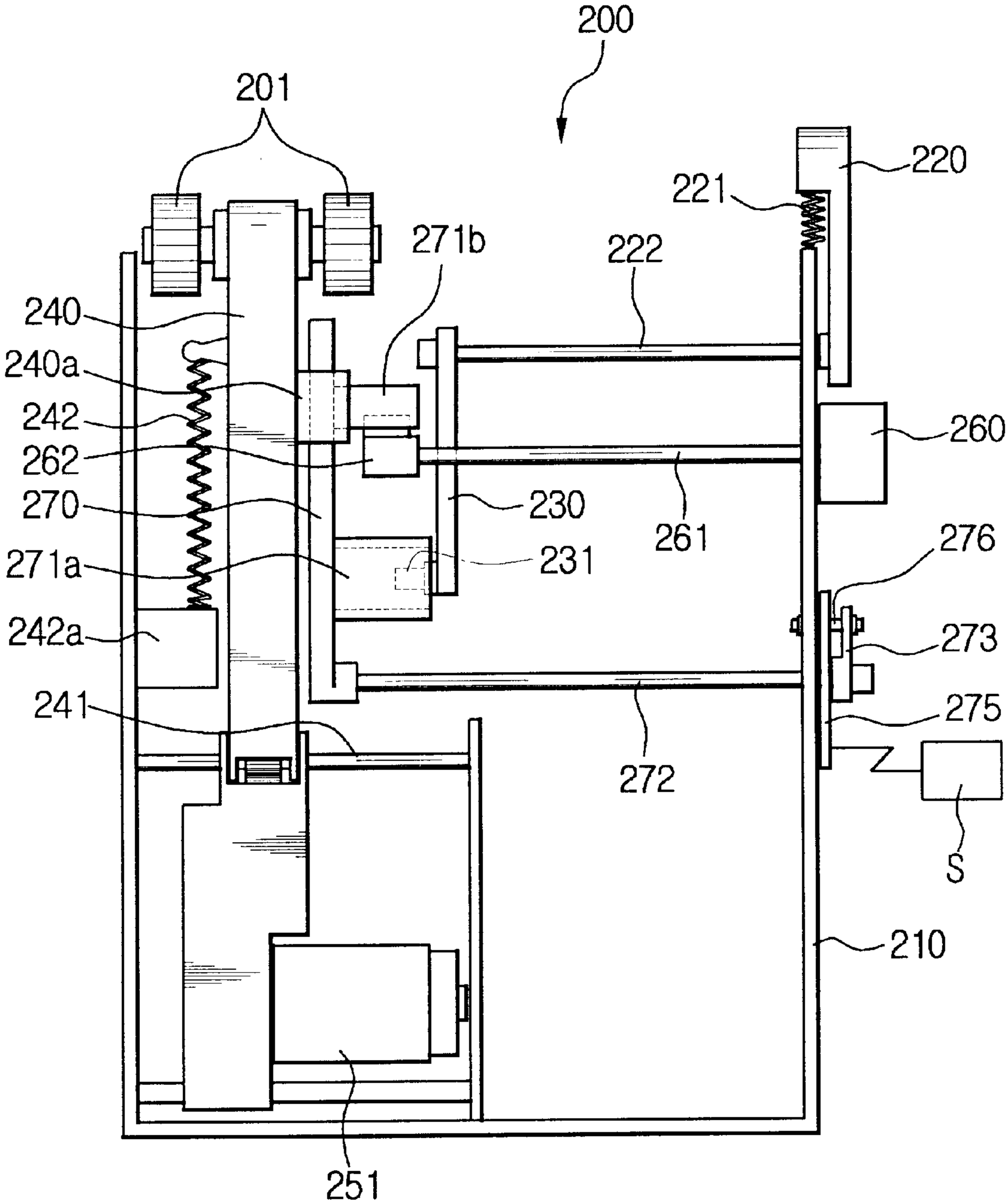

200
201
220
221
271b
222
240
240a
242
262
270
260
230
261
271a
231
276
242a
273
241
275
272
S
210
251

FIG.5

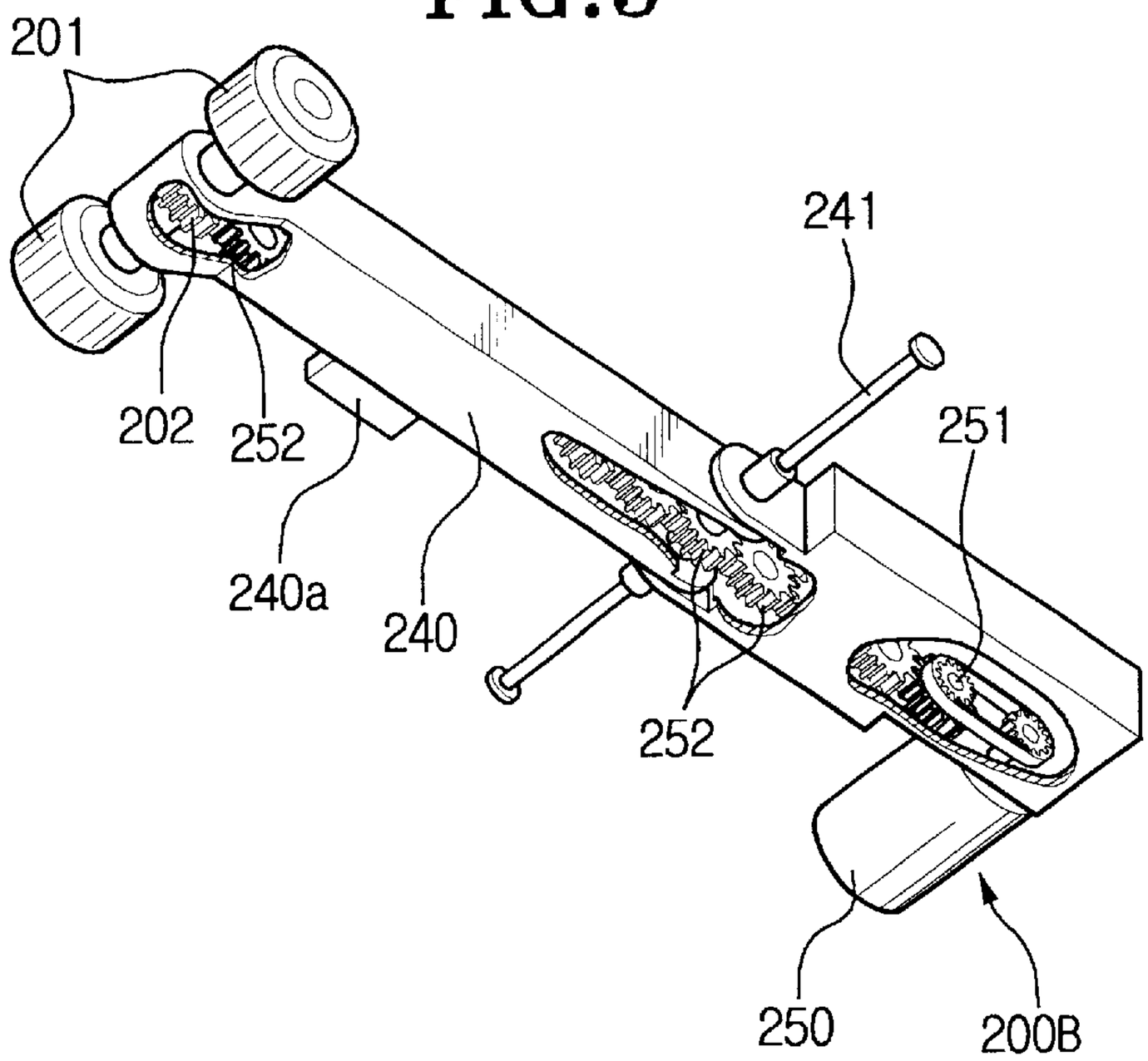

201
202
252
240a
240
241
251
252
250
200B

FIG.6

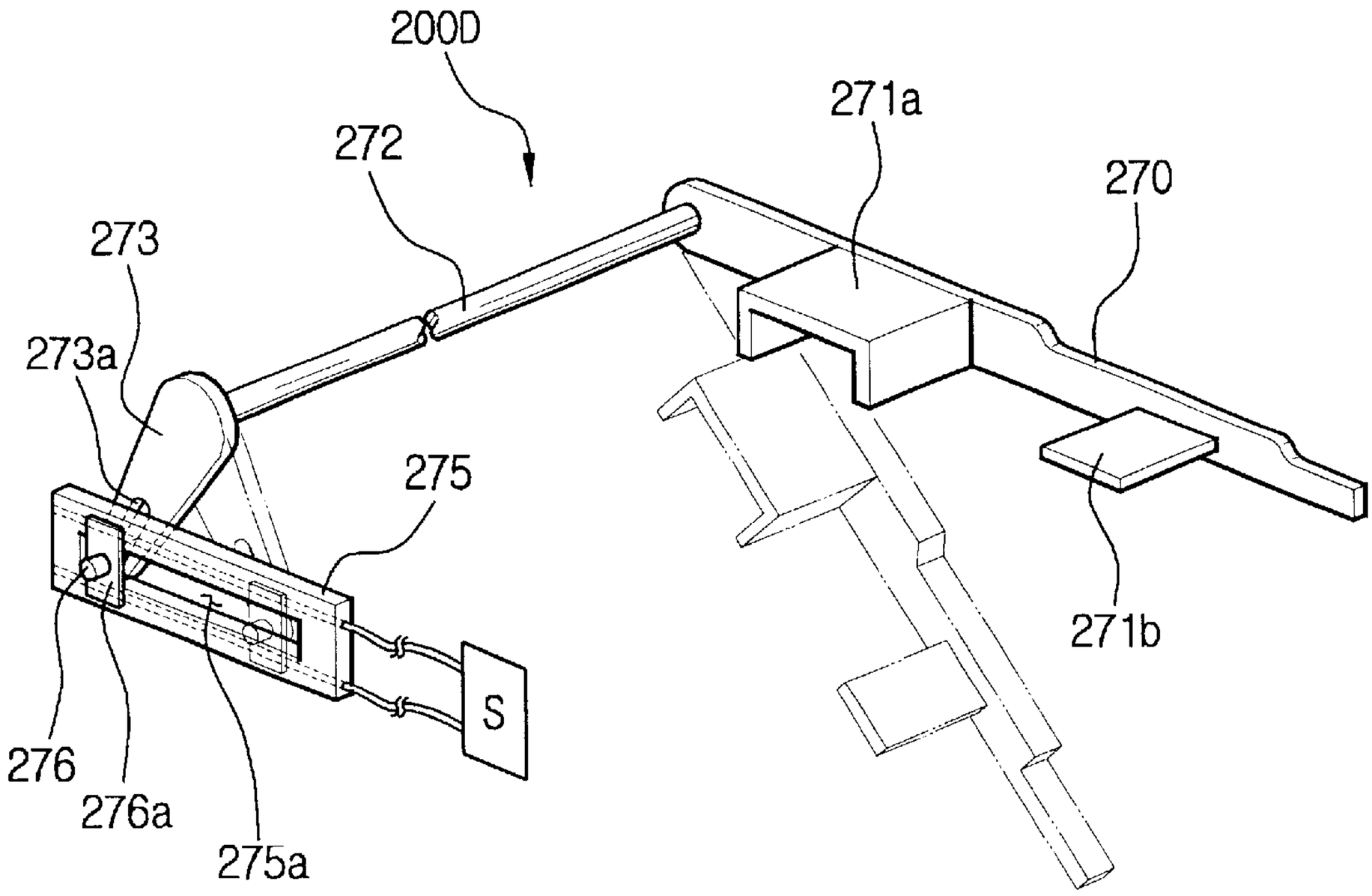

200D
272
271a
270
273
273a
275
271b
276
276a
275a
S

FIG.7

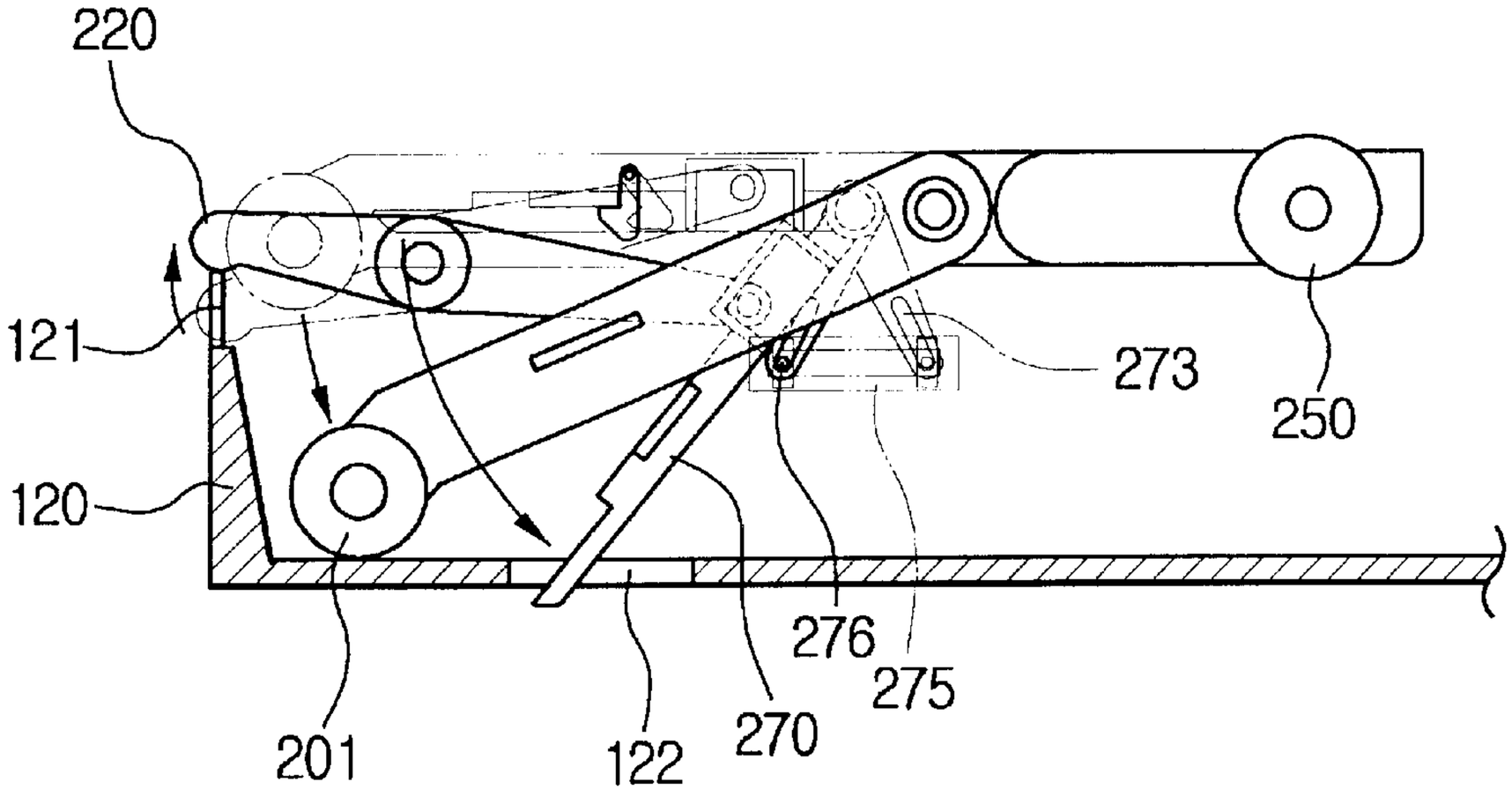
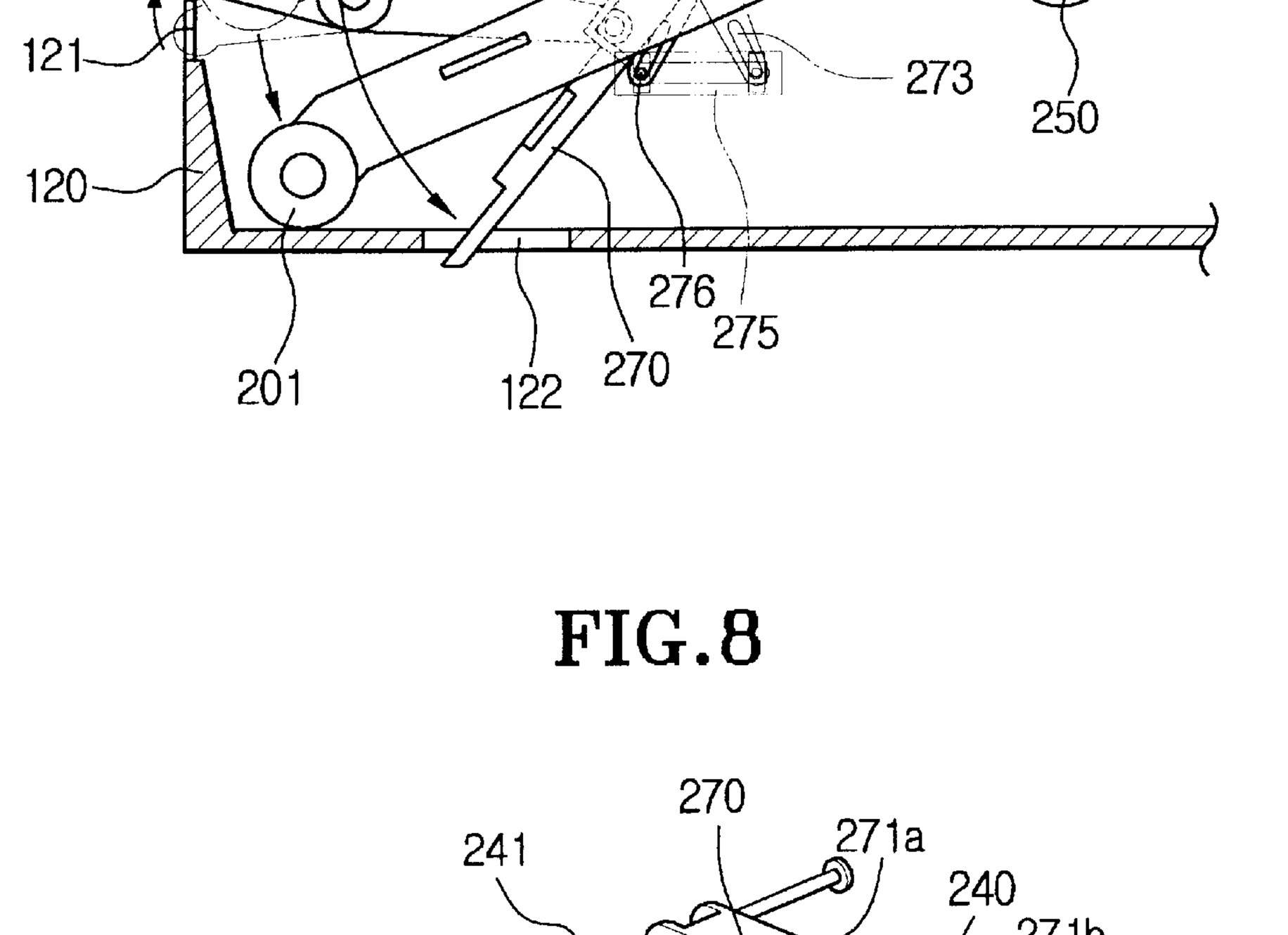

220
121
120
201
122
270
276
275
273
250

FIG.8


270
241
271a
240
271b
240a
272
273
275
231
261
262
201
222
230
276
260
220
121
120

PICKUP DEVICE FOR USE IN AN IMAGE FORMING APPARATUS

CLAIM OF PRIORITY

This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from my application PAPER PICK-UP DEVICE FOR IMAGE FORMING APPARATUS filed with the Korean Industrial Property Office on Dec. 29, 2000 and there duly assigned Serial No. 86388/2000.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to a pickup device for use in an image forming apparatus, such as a printer, a copier, or the like, for picking up paper from a cassette and feeding the picked up paper to an image forming engine portion. More particularly, the invention relates to a pickup device for use in an image forming apparatus having a pickup unit for driving a pickup roller upward and downward in association with loading/unloading of the cassette.

2. Related Art

Generally, an image forming apparatus, such as a laser printer, a copier or the like, has a pickup device for sequentially picking up paper which is stacked or piled on a cassette detachably mounted in a main body of the image forming apparatus. The picked up paper is fed to an image forming engine portion.

A conventional pickup device of an image forming apparatus includes a hopper plate formed on the bottom of the cassette which is removable from the body of the image forming apparatus. The hopper plate is biased upward by a spring. Plural sheets of paper are loaded on the hopper plate in such a manner that an uppermost sheet of paper is in close contact elastically with a pickup roller. As a result of a rotational driving force of the pickup roller, the uppermost sheet of paper is fed to the image forming engine portion.

Accordingly, in the conventional image forming apparatus as described above, the cassette is usually loaded in or unloaded from the image forming apparatus in a direction corresponding to the direction in which the paper is fed and discharged. Therefore, front and rear ends of the image forming apparatus have to be large enough to permit loading or unloading of a cassette for accommodating large-sized paper.

To solve the above-described problem, the cassette can be loaded or unloaded through a side of the body of the image forming apparatus. However, in this case, jamming of the uppermost sheet of paper often occurs while mounting the cassette in the body of the image forming apparatus.

SUMMARY OF THE INVENTION

The present invention has been developed in order to overcome the above-mentioned problems of the related art. Accordingly, it is an object of the present invention to provide a pickup device for use in an image forming apparatus capable of picking up and feeding paper through upward and downward driving of a pickup roller in association with loading/unloading of a paper cassette.

Another object of the present invention is to provide a pickup device for reducing the volumetric appearance of the image forming apparatus by feeding the paper in a direction perpendicular to a paper cassette loading or unloading direction.

Yet another object of the present invention is to provide a pickup device capable of detecting and displaying information about the amount of remaining paper or lack of paper while picking up and feeding the paper from the paper cassette.

In order to accomplish the above objects, the invention provides a pickup unit for use in an image forming apparatus for picking up a sheet of paper from a stack or pile of paper loaded in a cassette which is detachably mounted in a body of the image forming apparatus. The paper is provided to an image forming engine portion. The pickup unit includes: a pickup roller for feeding an uppermost sheet of paper from the pile of paper on the cassette in a predetermined direction by contacting it, and thus transmitting a rotational driving force thereto; loading/unloading means for moving the pickup roller upward and downward in association with the loading/unloading of the cassette; and driving means for transmitting the rotational driving force to the pickup roller, thereby feeding paper from the cassette sequentially.

According to one aspect of the present invention, the loading/unloading means includes: a cam projection protruding from a leading end of the cassette; a supporting frame disposed on a cassette mounting portion of the body; a cam lever formed on the supporting frame and elastically biased in a predetermined direction so as to be interfered with, and thus pivoted by, the cam projection during the loading/unloading of the cassette; a pickup bracket disposed on the supporting frame, the pickup bracket having a free end which is moved upward and downward while rotatably supporting the pickup roller; an elastic body for elastically biasing the free end of the pickup bracket toward the cassette; and a locking arm connected with the cam lever so as to be operated in association with the cam lever for selectively locking/unlocking the pickup bracket.

According to another aspect of the present invention, the loading/unloading means includes locking/unlocking means for selectively restricting, and thus setting, the pickup bracket to be able to move upward and downward by manipulation of a main controller which is formed on the body irrespective of the loading/unloading of the cassette. The locking/unlocking means includes: a solenoid unit disposed on the supporting frame and controlled by the main controller; a rotary shaft disposed on the supporting frame and pivoted according to operation of the solenoid unit; and a hook member disposed on one end of the rotary shaft for selectively restricting, and thus locking/unlocking, the pickup bracket according to a pivoting movement of the rotary shaft.

According to yet another aspect of the present invention, the pickup unit includes paper remainder detecting means for detecting the remainder of the stack of paper, and for displaying detected information. The paper remainder detecting means includes: a paper contact lever moved upward and downward by the loading/unloading means to contact with the stack of paper on the cassette; a link arm pivoted in association with the paper contact lever, the link arm having a long hole formed in a body thereof; a guide portion disposed on the supporting frame and in parallel relation with respect to a side of the link arm, the guide portion having a guide slit overlapping a travel path of the long hole during a pivoting of the link arm; a slide pin restrictively connected in such a manner that it is passed through the long hole and the guide slit, said slide pin being linearly slid according to the pivoting of the paper contact lever and the link arm; and sensing means for detecting and outputting information about a displacement location of the slide pin in the form of a signal.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings, in which like reference numerals indicate the same or similar components, and wherein:

FIG. **1** is a schematic sectional view showing a pickup device employed in an image forming apparatus;

FIG. **2** is a schematic perspective view showing the main portion (i.e., the pickup device) according to the present invention;

FIG. **3** is a perspective view showing in detail the structure of the pickup device of an image forming apparatus according to the present invention;

FIG. **4** is a plan view schematically showing the pickup unit of FIGS. **2** and **3**;

FIG. **5** is a partially cutaway perspective view schematically showing a pickup roller driving portion formed in the pickup device of the image forming apparatus according to a preferred embodiment of the present invention;

FIG. **6** is a perspective view schematically showing the main portion (i.e., a paper termination/remainder detecting portion) formed in the pickup device of the image forming apparatus according to the present invention;

FIG. **7** is a schematic sectional view showing the paper termination/remainder detecting portion of FIG. **6**, and is used to explain the operation thereof; and

FIG. **8** is a partially cutaway perspective view schematically showing the main portion (i.e., the pickup device) of the image forming apparatus according to the present invention, and is used to explain the operation thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention will be described in further detail by way of example with reference to the attached drawings.

FIG. **1** schematically shows a pickup device of an image forming apparatus, including a hopper plate **21** formed on the bottom of the cassette **20**, while is removable from a body **10** of the image forming apparatus. As shown, the hopper plate **21** is biased upward by a spring **22**. Plural sheets of paper **1** are loaded on the hopper plate **21** in such a manner that an uppermost sheet of the paper **1** is in close contact elastically with a pickup roller **11**. As a result of a rotational driving force of the pickup roller **11**, the uppermost sheet of paper **1** is fed to the image forming engine portion (not shown).

Accordingly, in the image forming apparatus as described above, the cassette **20** is usually loaded in or unloaded from the image forming apparatus in a direction corresponding to the direction in which the paper is fed and discharged. Therefore, front and rear ends of the image forming apparatus have to be large enough to permit loading or unloading of a cassette for accommodating large-sized paper.

To solve the above-described problem, the cassette **20** can be loaded or unloaded through a side of the body of the image forming apparatus. However, jamming of the uppermost sheet of paper often occurs while mounting the cassette **20** in the body of the image forming apparatus.

FIG. **2** is a schematic perspective view showing the main portion (i.e., the pickup device) according to the present invention. Referring to FIG. **2**, the pickup device of the

image forming apparatus according to the present invention includes a pickup unit **200** mounted in a cassette mounting portion **101** of an image forming apparatus body **100** for sequentially picking up and feeding the paper from the cassette **120** to an image forming engine portion **110**.

According to the present invention, the pickup unit **200** includes a pickup roller **201** for feeding the paper in a direction perpendicular to a loading/unloading direction of cassette **120**, a loading/unloading portion **200**A for driving the pickup roller **201** upward and downward with respect to an upper portion of the paper in association with the loading/unloading of the cassette **120**, and a driving portion **200**B for transmitting a rotational driving force to the pickup roller **201** for sequentially feeding the paper from the cassette **120**.

According to the pickup device of the image forming apparatus of the present invention, the pickup roller **201** is mounted in a direction perpendicular to the cassette loading/unloading direction. As shown in FIG. **2**, the cassette **120** is loaded or unloaded in a direction perpendicular to the direction in which the paper is picked up and fed with respect to the image forming apparatus body **100**.

FIG. **3** is a perspective view showing in detail the structure of the pickup device of an image forming apparatus according to the present invention, while FIG. **4** is a plan view schematically showing the pickup unit of FIGS. **2** and **3**. Referring to FIGS. **3** and **4**, the loading/unloading portion **200**A includes: a cam projection **121** formed on a leading end of the cassette **120**, and having a cam curve formed thereon; a supporting frame **210** mounted on the cassette mounting portion **101** of the body **100**; a cam lever **220** mounted on the supporting frame **210** for being interfered with, and pivoted by, the cam projection **121** during loading/unloading of the cassette; a locking arm **230** for pivoting in association with the cam lever **220** in a direction opposite to that of the cam lever **220**; and a pickup bracket **240** pivotally mounted on a supporting shaft **241**, which is mounted on the supporting frame **210**, for being restricted and moved upward and downward by the locking arm **230**.

The cam lever **220** is elastically biased downward toward the cassette **120** by a spring **221** disposed on the body **100**, and cam lever **220** is connected to the locking arm **230** via a rotational shaft **222** that is used for the rotation in unison of the cam lever **220** and the locking arm **230**.

The locking arm **230** restricts the movement of the pickup bracket **240** to the upward and downward direction as a locking pin **231**, formed on a free end of the locking arm **230**, directly and indirectly interferes with the pickup bracket **240** during a pivoting of the locking arm **230**.

The locking arm **230** indirectly restricts the movement of the pickup bracket **240** to the upward and downward direction by being operated in association with a hook member **262** of a locking/unlocking means **200**C and/or a paper contact lever **270** of a paper remainder detecting means **200**D. The locking/unlocking means **200**C and the paper remainder detecting means **200**D will be described later.

Although it is not shown in the drawings, the locking pin **231** of the locking arm **230** may directly restrict movement of the pickup bracket **240** to the upward and downward direction.

While rotatably supporting the pickup roller **201**, the free end of the pickup bracket **240** is elastically biased downward to the cassette **120** by the spring **242**, which is disposed on a supporting portion **242***a* of the supporting frame **210**.

Since the pickup roller **201** feeds the uppermost paper on the cassette **120** under proper pressure, slip occurrence is prevented.

FIG. **5** is a partially cutaway perspective view schematically showing a pickup roller driving portion formed in the pickup device of the image forming apparatus according to a preferred embodiment of the present invention. According to the present invention, as shown in FIG. **5**, the driving portion or means **200**B of the pickup roller **201** includes a driving motor **250** supported on the supporting frame **210**, and a power transmitting means disposed on the pickup bracket **240** for transmitting the rotational driving force of the driving motor **250** to the pickup roller **201**.

According to one aspect of the present invention, the power transmitting means includes a belt pulley **251** connected to an output side of the driving motor **250**, a driven gear **202** disposed on a rotary axle of the pickup roller **201**, and a plurality of connecting gears **252** disposed in the pickup bracket **240** for connection to the belt pulley **251**.

Meanwhile, in the pickup device of the image forming apparatus according to the present invention, pickup unit **200** (referring back to FIG. **3**) includes the locking/unlocking means **200**C for selectively restricting and movably setting the pickup bracket **240** upward and downward by the manipulation of a main controller (not shown), formed in the body **100**, irrespective of the loading/unloading of the cassette **120**.

According to one aspect of the present invention, the locking/unlocking means **200**C includes a solenoid driving unit **260** disposed on the supporting frame **210** so as to be controlled by the key input manipulation of the main controller (not shown), a rotary shaft **261** disposed on the supporting frame **210** so as to be rotated by the operation of the solenoid driving unit **260**, and a hook member **262** disposed on one end of the rotary shaft **261** for directly or indirectly restricting and thus locking/unlocking, the pickup bracket **240** according to the rotation of the rotary shaft **261**.

In association with the paper contact lever **270** of the paper remainder detecting means **200**D, the hook member **262** indirectly interferes with, and thus restricts the movement of, the pickup bracket **240** to the upward and downward directions.

In the pickup device of the image forming apparatus according to the present invention, a pickup unit **200** includes the paper remainder detecting means **200**D for detecting and indicating information about lack of paper and/or remainder of paper stacked on the cassette **120**.

FIG. **6** is a perspective view schematically showing the main portion (i.e., a paper termination/remainder detecting portion) formed in the pickup device of the image forming apparatus according to the present invention, FIG. **7** is a schematic sectional view showing the paper termination/remainder detecting portion of FIG. **6**, used to explain the operation thereof, and FIG. **8** is a partially cutaway perspective view schematically showing the main portion (i.e., the pickup device) of the image forming apparatus according to the present invention used to explain the operation thereof.

Referring to FIG. **6**, the paper remainder detecting means **200**D includes paper contact lever **270** rotatably disposed on the rotary shaft **272** on the supporting frame **210** in a parallel relation with respect to one side of the pickup bracket **240**, a link arm **273** rotated in association with the paper contact lever **270**, a guide portion **275** disposed on the supporting frame **210** in a parallel relation with respect to the link arm **273**, and a slide pin **276** movably passed through the link arm **273** and the guide portion **275**.

The paper contact lever **270** includes a locking elevation **271***a* and a locking segment **271***b* respectively protruding from the body thereof. Accordingly, as the locking elevation **271***a* and the locking segment **271***b* are respectively restricted by the hook member **262** of the locking/unlocking means **200**C, movement of the paper contact lever **270** is restricted to the upward and downward directions.

The link arm **273** has a long hole **273***a* formed lengthwise on the free end thereof, while the guide portion **275** has a guide slit **275***a* formed lengthwise on the body thereof and overlapping a traveling path of the long hole **273***a* during a pivoting of the link arm **273**.

Accordingly, in the process of being inserted through the long hole **273***a* and the guide slit **275***a*, the slide pin **276** is connected to the connecting portion **276***a* so as to be displaced by being linearly moved along the guide slit **275***a* during the pivoting of the link arm **273**.

In this case, information as to the displacement location of the slide pin **276** is detected by a sensing means S in the form of a signal which is output to the main controller (not shown). Accordingly, the information about paper remaining in the cassette **120** is displayed.

The sensing means S may have a structure in which an outline of the guide slit **275***a* of the guide potion **275** is formed as an electric conductor electrically connected to a power input/output lead line. The sensing means S may also have a structure in which a conductor contacts the end of the slide pin **276**, thereby detecting electrical resistance or an electric current value variably output according to the displacement location of the slide pin **276**, and converting the detected value into a corresponding electrical signal. Furthermore, the sensing means S may have a structure in which one of various types of sensors, such as a photo-sensor, is employed to detect the displacement location of the slide pin **276**, and to output the detected result in the form of a corresponding electric signal.

Referring to FIGS. **3** thru **6**, while the paper contact lever **270** is moved downwardly by the sequential restriction and release of the locking pin **231** and the hook member **262**, the paper contact lever **270** is upwardly moved only by the restriction of the locking pin **231** during the pivoting of the locking arm **230**.

The pickup bracket **240** has a projecting portion **240***a* protruding from the body thereof so as to be mounted on the body of the paper contact lever **270**. Accordingly, the pickup bracket **240** is moved upward and downward in association with the paper contact lever **270**.

The pickup device of the image forming apparatus according to the present invention includes a paper termination detecting means for detecting presence of the paper on the cassette **120**. In other words, the paper termination detecting means detects whether or not there is a 'no paper' state.

The paper termination detecting means includes a slit **122** (see FIGS. **2**, **3**, and **7**) formed in the bottom of cassette **120** for permitting the leading end of the paper contact lever **270** to pass therethrough.

Accordingly, as shown in FIG. **7**, when the leading end of the paper contact lever **270** passes downward through the slit **122**, the slide pin **276** detects the 'no paper' state according to the signal output as the slide pin **276** is moved to a corresponding location.

In another embodiment, information about the 'no paper' state can also be displayed by forming a separate sensor, such as a photo-sensor (not shown), around the slit **122** for detecting whether or not the leading end of the slide pin **276** has passed through the slit **122**.

The operation for picking up paper from the cassette **120** with the pickup device of the image forming apparatus,

constructed as described above according to the present invention, will now be described in greater detail below with reference to the accompanying drawings.

As shown in FIGS. **2**, **3** and **8**, when the cassette **120** holding paper is mounted on the cassette mount portion **110**, the cam lever **220** interferes with the cam projection **121** formed on the leading end of the cassette **120**, and is thus pivoted upward while the locking arm **230** is simultaneously pivoted downward.

Accordingly, the locking elevation **271***a* of the paper contact lever **270** is released by the locking pin **231** of the locking arm **240**, while the locking segment **271***b* of the paper contact lever **270** is continuously restricted by the hook member **262** of the locking/unlocking means **200**C. As a result, the paper contact lever **270** is maintained in an initial setting state.

In such a situation, as the user manipulates the control panel and thus inputs a print command to the main controller of the image forming apparatus, the main controller (not shown) operates the solenoid unit **260** of the locking/unlocking means **200**C, and thus pivots the rotary shaft **261** to a predetermined angle.

Accordingly, the hook member **262** is rotated in association with the rotary shaft **261**, and the paper contact lever **270** is released from the locking segment **271***b*. As the paper contact lever **270** is released from the locking segment **271***b*, the free end of the paper contact lever **270** falls free, and accordingly, the paper contact lever **270** is displaced downward into contact with an uppermost paper of the stack of paper on the cassette **120**.

Meanwhile, due to the downward displacement of the paper contact lever **270**, the paper remainder detecting means **200**D is operated. That is, during the downward displacement of the paper contact lever **270**, the link arm **273** is accordingly pivoted, and the slide pin **276** located in the long hole **273***a* is slid linearly along the guide slit **275***a* of the guide portion **275**.

The downward displacement distance of the paper contact lever **270** is determined according to the height of the stack of paper on the cassette **120**, while the displacement location of the slide pin **276** is also determined according to such determined downward displacement distance of the paper contact lever **270**.

Since the information about the displacement location or displacement distance of the slide pin **276** can be detected by the sensing means S connected thereto, and can be output to the main controller, the information about the paper remaining in the cassette **120** can be displayed.

To implement a signal detecting and outputting method of the sensing means S, the outline of the guide slit **275***a* of the guide portion **275** can be formed of a conductor connected to the lead line of the power input/output. In another embodiment, the end of the slide pin **276** may be brought into contact with the conductor for detecting electrical resistance or an electric current value variably output according to the displacement location of the slide pin **276**, and for converting such detected value into an electrical signal.

Further, since the paper contact lever **270** is gradually de-elevated by a minute distance according to the gradual decrease in the stack of paper in the cassette **120**, the change in the displacement distance can be reflected through the slide pin **276**, while the information about the amount of paper remaining in the cassette **120** is provided in real time.

Here, in the event of complete exhaustion of the paper in the cassette **120**, the leading end of the paper contact lever **270** passes through the slit **122** formed in the bottom of the cassette **120**. Based on such a state of the paper contact lever **270**, the 'no paper' state can be detected and displayed. The information can be detected by using the above-described sensing means S, or by using another sensor, such as a photo-sensor, that can detect whether or not the leading end of the paper contact lever **270** has passed through the slit **122**.

As described above, as the paper contact lever **270** is displaced downward, the pickup bracket **240** is released from the locking segment **271***b*, and is thus downwardly displaced.

The pickup bracket **240** is elastically biased downward by the tension of the spring **242** disposed on the leading end thereof, and accordingly, the pickup roller **201** contacts the uppermost paper in the pile of paper on the cassette **120** under a predetermined tension.

When the paper contact lever **270** and the pickup bracket **240** are downwardly displaced, by the sequential controlling of the main controller (not shown), the pickup roller driving means **200**B is operated. Accordingly, the rotational driving force of the driving motor **250** is transmitted to the pickup roller **201** through the power transmitting means, such as the belt pulley **251** and the plurality of connecting gears **252**, and the pickup roller **201** sequentially feeds the paper stacked in the cassette **120** to the image forming engine portion **110**.

Meanwhile, according to the pickup device of the image forming apparatus according to the present invention, in the event of complete paper exhaustion, the cassette **120** is removed from the image forming apparatus body so as to be loaded with a new stack of paper. In such a case, the cam lever **220** is released by the cam projection **121** of the cassette **120**, and pivoted downward by the tension of the spring **221**, while the locking arm **230** is simultaneously pivoted upward accordingly.

Accordingly, the locking pin **231** of the locking arm **230** restricts, and thus lifts, the locking elevation **271***a* of the paper contact lever **270**, while the projecting portion **240***a* formed at one end of the pickup bracket **240**, and mounted on the locking segment **271***b* of the paper contact lever **270**, is restricted and simultaneously lifted.

Accordingly, in the pickup device of the image forming apparatus according to the present invention, since the pickup roller **201** is elevated or de-elevated in association with the loading/unloading of the cassette **120**, possible collision of the cassette **120** with the pickup roller **201**, or interference of the pickup roller **201** with the paper, can be prevented.

According to the pickup device of the image forming apparatus according to the present invention, the following effects can be achieved.

First, the overall size of the image forming apparatus can be reduced. In other words, since the pickup roller **201** is moved upward and downward in association with the loading/unloading of the cassette **120** to prevent interference between the pickup roller **201** and the uppermost paper during the loading of the cassette **120**, the cassette **120** can be loaded and unloaded with respect to the body of the image forming apparatus in a perpendicular direction relative to the direction in which the paper is fed and discharged. As a result, the image forming apparatus according to the present invention can be kept relatively compact compared to a method in which the cassette is loaded and unloaded in the same direction as the direction in which paper feeding and discharge take place.

Second, since the pickup roller **201** is downwardly displaced according to the loading/unloading of the cassette and the input of the print command, the possible collision between the cassette **120** and the pickup roller **201**, and interference between the pickup roller **201** and the paper, can be prevented. Accordingly, the occurrence of mechanical problems can be minimized, and improved performance and life span can be expected.

Finally, since information about the exhaustion of paper and/or the amount of paper remaining in the cassette **120** can be detected and provided in real time upon loading the cassette **120** or performing the printing process, the user is provided with convenience in use.

Although the preferred embodiments of the present invention have been described, it will be understood by those skilled in the art that the present invention should not be limited to the described preferred embodiments, but various changes and modifications can be made within the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A pickup device for picking up a sheet of paper from a stack of paper loaded in a cassette which is detachably mounted in a body of an image forming apparatus, and for feeding the picked up paper to an image forming engine portion, said pickup device comprising:

a pickup roller for feeding an uppermost sheet of paper of the stack of paper in the cassette in a predetermined direction by contacting, and thus transmitting a rotational driving force to, the uppermost sheet of paper;

loading/unloading means for moving the pickup roller upward and downward in association with loading and unloading of the cassette; and

driving means for transmitting the rotational driving force to the pickup roller, thereby enabling the pickup roller to feed the paper from the cassette sequentially.

2. The pickup device of claim **1**, wherein the loading/unloading means comprises:

a cam projection protruding from a leading end of the cassette;

a supporting frame disposed on a cassette mount portion of the body;

a cam lever formed on the supporting frame and elastically biased in a predetermined direction for being interfered with, and thus pivoted by, the cam projection during the loading and unloading of the cassette;

a pickup bracket disposed on the supporting frame and having a free end which moves upward and downward while rotatably supporting the pickup roller;

an elastic body for elastically biasing the free end of the pickup bracket toward the cassette; and

a locking arm connected to the cam lever so as to be operated in association with the cam lever, the locking arm selectively locking and unlocking the pickup bracket.

3. The pickup device of claim **2**, further comprising locking/unlocking means for selectively restricting movement of the pickup bracket so that the pickup bracket moves upward and downward by manipulation of a main controller, which is formed on the body of the image forming apparatus, irrespective of the loading and unloading of the cassette.

4. The pickup device of claim **3**, wherein the locking/unlocking means comprises:

a solenoid unit disposed on the supporting frame and controlled by the main controller;

a rotary shaft disposed on the supporting frame and pivoted according to operation of the solenoid unit; and

a hook member disposed on one end of the rotary shaft for selectively restricting movement of the pickup bracket according to pivoting movement of the rotary shaft.

5. The pickup device of claim **2**, wherein the driving means comprises:

a driving motor disposed on the supporting frame; and

a power transmitting unit for transmitting a rotational driving force from the driving motor to the pickup roller.

6. The pickup device of claim **5**, wherein the power transmitting unit comprises a belt pulley disposed on the pickup bracket, and connected to an output shaft of the driving motor and to a rotary shaft of the pickup roller.

7. The pickup device ofclaim **5**, wherein the pickup roller has a rotary shaft on which a driving gear is disposed, and wherein the power transmitting unit comprises:

a belt pulley disposed on the pickup bracket and connected to an output shaft of the driving motor; and

a plurality of connecting gears disposed on the pickup bracket for connecting the driving gear disposed on the rotary shaft of the pickup roller with the belt pulley.

8. The pickup device of claim **1**, wherein the driving means comprises:

a driving motor; and

a power transmitting unit for transmitting a rotational driving force from the driving motor to the pickup roller.

9. The pickup device of claim **8**, wherein the power transmitting unit comprises a belt pulley disposed on the pickup bracket, and connected to an output shaft of the driving motor and a rotary shaft of the pickup roller.

10. The pickup device of claim **8**, wherein the pickup roller has a rotary shaft on which a driving gear is disposed, and wherein the power transmitting unit comprises:

a belt pulley disposed on the pickup bracket and connected to an output shaft of the driving motor; and

a plurality of connecting gears disposed on the pickup bracket for connecting the driving gear disposed on the rotary shaft of the pickup roller with the belt pulley.

11. The pickup device of claim **1**, wherein the image forming apparatus further comprises paper remainder detecting means for detecting a remainder of the stack of paper, and for displaying detected remainder information.

12. The pickup device of claim **11**, wherein the paper remainder detecting means comprises:

a paper contact lever which is moved upward and downward by the loading/unloading means to contact the stack of paper in the cassette;

a link arm which pivots in association with the paper contact lever, the link arm having a long hole formed in a body thereof;

a guide portion disposed in a parallel relation with respect to a side of the link arm, the guide portion having a guide slit overlapping a travel path of the long hole during a pivoting of the link arm;

a slide pin restrictively connected to said link arm and said guide portion by passing through the long hole and the guide slit, respectively, for linearly sliding according to the pivoting of the paper contact lever and the link arm; and

a sensing unit for detecting a displacement location of the slide pin and for outputting displacement information in the form of an electric signal.

13. The pickup device of claim 12, wherein the paper remainder detecting means detects information about presence and absence of the paper in the cassette according to whether or not a free end of the paper contact lever passes through a slit formed in a bottom of the cassette.

14. The pickup device of claim 1, wherein the pickup roller feeds the uppermost sheet of paper in a direction perpendicular to a direction in which the cassette is loaded and unloaded.

15. A pickup device for picking up a sheet of paper from a stack of parer loaded in a cassette which is detachably mounted in a body of an image forming apparatus, and for feeding the picked up paper to an image forming engine portion, said pickup device comprising:

a pickup roller for feeding an uppermost sheet of paper of the stack of paper in the cassette in a predetermined direction by contacting, and thus transmitting a rotational driving force to, the uppermost sheet of paper;

loading/unloading means for moving the pickup roller upward and downward in association with loading and unloading of the cassette; and

driving means for transmitting the rotational driving force to the pickup roller, thereby enabling the pickup roller to feed the paper from the cassette sequentially;

wherein the image forming apparatus further comprises paper remainder detecting means for detecting a remainder of the stack of paper, and for displaying detected remainder information; and

wherein the paper remainder detecting means comprises:

a paper contact lever which is moved upward and downward by the loading/unloading means to contact the stack of paper in the cassette; and

wherein the paper remainder detecting means detects information about presence and absence of the paper in the cassette according to whether or not a free end of the paper contact lever passes through a slit formed in a bottom of the cassette.

16. A pickup device for picking up a sheet of paper from a stack of paper loaded in a cassette which is detachably mounted in a body of an image forming apparatus, and for feeding the picked up paper to an image forming engine portion, said pickup device comprising:

a pickup roller for feeding an uppermost sheet of paper of the stack of paper in the cassette in a predetermined direction by contacting, and thus transmitting a rotational driving force to, the uppermost sheet of paper;

loading/unloading means for moving the pickup roller upward and downward in association with loading and unloading of the cassette; and

driving means for transmitting the rotational driving force to the pickup roller, thereby enabling the pickup roller to feed the paper from the cassette sequentially

wherein said loading/unloading means comprises a pickup bracket having a free end which moves upward and downward while rotatably supporting the pickup roller;

said pickup device further comprising locking/unlocking means for selectively restricting movement of the pickup bracket so that the pickup bracket moves upward and downward by manipulation of a main controller, which is formed on the body of the image forming apparatus, irrespective of the loading and unloading of the cassette.

17. The pickup device of claim 16, wherein said loading/unloading means comprises a supporting frame disposed on a cassette mount portion of the body; and

wherein said locking/unlocking means comprises a hook member disposed on one end of the rotary shaft for selectively restricting movement of the pickup bracket according to pivoting movement of the rotary shaft.

18. An image forming apparatus, comprising:

a body;

an image forming engine portion;

a cassette detachably mounted in the body for holding a stack of paper loaded in the cassette;

pickup means for picking up a sheet of paper from the stack, and for feeding the pickup paper to the image forming engine portion; and

paper remainder detecting means for detecting a remainder of the stack of paper, and for displaying detected remainder information;

wherein said pickup means comprises:

a pickup roller for feeding an uppermost sheet of paper of the stack of paper in the cassette in a predetermined direction by contacting, and thus transmitting a rotational driving force to, the uppermost sheet of paper; and

a loading/unloading unit for moving the pickup roller upward and downward in association with loading and unloading of the cassette.

19. The apparatus of claim 18, wherein said pickup means further comprises:

a driving unit for transmitting the rotational driving force to the pickup roller, thereby enabling the pickup roller to feed the paper from the cassette sequentially.

20. The apparatus of claim 19, wherein said loading/unloading unit comprises:

a cam projection protruding from a leading end of the cassette;

a supporting frame disposed on a cassette mount portion of the body;

a cam lever formed on the supporting frame and elastically biased in a predetermined direction for being interfered with, and thus pivoted by, the cam projection during the loading and unloading of the cassette;

a pickup bracket disposed on the supporting frame and having a free end which moves upward and downward while rotatably supporting the pickup roller;

an elastic body for elastically biasing the free end of the pickup bracket toward the cassette; and

a locking arm connected to the cam lever so as to be operated in association with the cam lever, the locking arm selectively locking and unlocking the pickup bracket.

21. The apparatus of claim 20, further comprising a main controller formed on the body, and wherein said pickup means comprises a locking/unlocking unit for selectively restricting movement of the pickup bracket so that the pickup bracket moves upward and downward by manipulation of the main controller irrespective of the loading and unloading of the cassette.

22. The apparatus of claim 21, wherein the locking/unlocking unit comprises:

a solenoid unit disposed on the supporting frame and controlled by the main controller;

a rotary shaft disposed on the supporting frame and pivoted according to operation of the solenoid unit; and

a hook member disposed on one end of the rotary shaft for selectively restricting movement of the pickup bracket according to pivoting movement of the rotary shaft.

23. The apparatus of claim 20, wherein the driving unit comprises:

a driving motor disposed on the supporting frame; and

a power transmitting unit for transmitting a rotational driving force from the driving motor to the pickup roller.

24. The apparatus of claim 23, wherein the power transmitting unit comprises a belt pulley disposed on the pickup bracket, and connected to an output shaft of the driving motor and to a rotary shaft of the pickup roller.

25. The apparatus of claim 23, wherein the pickup roller has a rotary shaft on which a driving gear is disposed, and wherein the power transmitting unit comprises:

a belt pulley disposed on the pickup bracket and connected to an output shaft of the driving motor; and

a plurality of connecting gears disposed on the pickup bracket for connecting the driving gear disposed on the rotary shaft of the pickup roller with the belt pulley.

26. The apparatus of claim 19, wherein the paper remainder detecting means comprises:

a paper contact lever which is moved upward and downward by the loading/unloading unit to contact the stack of paper in the cassette;

a link arm which pivots in association with the paper contact lever, the link arm having a long hole formed in a body thereof;

a guide portion disposed in a parallel relation with respect to a side of the link arm, the guide portion having a guide slit overlapping a travel path of the long hole during a pivoting of the link arm;

a slide pin restrictively connected to said link arm and said guide portion by passing through the long hole and the guide slit, respectively, for linearly sliding according to the pivoting of the paper contact lever and the link arm; and

a sensing unit for detecting a displacement location of the slide pin and for outputting displacement information in the form of an electric signal.

27. The apparatus of claim 26, wherein the paper remainder detecting means detects information about presence and absence of the paper in the cassette according to whether or not a free end of the paper contact lever passes through a slit formed in a bottom of the cassette.

28. The apparatus of claim 19, further comprising a main controller formed on the body; and

wherein said loading/unloading unit comprises a pickup bracket having a free end which moves upward and downward while rotatably supporting the pickup roller;

said pickup means further comprising a locking/unlocking unit for selectively restricting movement of the pickup bracket so that the pickup bracket moves upward and downward by manipulation of the main controller irrespective of the loading and unloading of the cassette.

29. The apparatus of claim 28, wherein said loading/unloading unit comprises a supporting frame disposed on a cassette mount portion of the body; and

wherein said locking/unlocking unit comprises a hook member disposed on one end of the rotary shaft for selectively restricting movement of the pickup bracket according to pivoting movement of the rotary shaft.

30. The apparatus of claim 19, wherein the pickup roller feeds the uppermost sheet of paper in a direction perpendicular to a direction in which the cassette is loaded and unloaded.

31. The apparatus of claim 19, wherein the driving unit comprises:

a driving motor; and

a power transmitting unit for transmitting a rotational driving force from the driving motor to the pickup roller.

32. The apparatus of claim 31, wherein the power transmitting unit comprises a belt pulley disposed on the pickup bracket, and connected to an output shaft of the driving motor and to a rotary shaft of the pickup roller.

33. The apparatus of claim 31, wherein the picking roller has a rotary shaft on which a driving gear is disposed, and wherein the power transmitting unit comprises:

a belt pulley disposed on the pickup bracket and connected to an output shaft of the driving motor; and

a plurality of connecting gears disposed on the pickup bracket for connecting the driving gear disposed on the rotary shaft of the pickup roller with the belt pulley.

34. An image forming apparatus comprising:

a body;

an image forming engine portion;

a cassette detachably mounted in the body for holding a stack of paper loaded in the cassette;

pickup means for picking up a sheet of paper from the stack, and for feeding the pickup paper to the image forming engine portion; and

paper remainder detecting means for detecting a remainder of the stack of paper, and for displaying detected remainder information;

wherein the paper remainder detecting means comprises:

a paper contact lever which is moved upward and downward to contact the stack of paper in the cassette; and

wherein the paper remainder detecting means detects information about presence and absence of the paper in the cassette according to whether or not a free end of the paper contact lever passes through a slit formed in a bottom of the cassette.

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